Survey of ISO Standards for Geospatial Metadata

Liping Di
ldi@gmu.edu
Center for Spatial Information Science and Systems
George Mason University

Introduction

- ISO TC 211 is an ISO technical committee responsible for setting international standards on geographic information.
- ISO TC 211 has set a series of metadata standards for describing geospatial resources (e.g., data, services, catalogs).
- This presentation gives a brief introduction of ISO metadata standards developed by ISO TC 211.
  - The main metadata standards:ISO 19115, ISO 19115-2, and ISO/TS 19130.
  - The associated quality standards: ISO 19113, ISO 19114, and ISO 19138.

ISO 19113: Quality Principles

- ISO 19113:2002 defines the principles for describing the quality of geographic data and specifies components for reporting quality information. It also provides an approach to organizing information about data quality.
- ISO 19113:2002 is applicable to data producers providing quality information to describe and assess how well a dataset meets its mapping of the universe of discourse as specified in the product specification, formal or implied, and to data users attempting to determine whether or not specific geographic data is of sufficient quality for their particular application.
- ISO 19113:2002 does not define a minimum acceptable level of quality for geographic data.

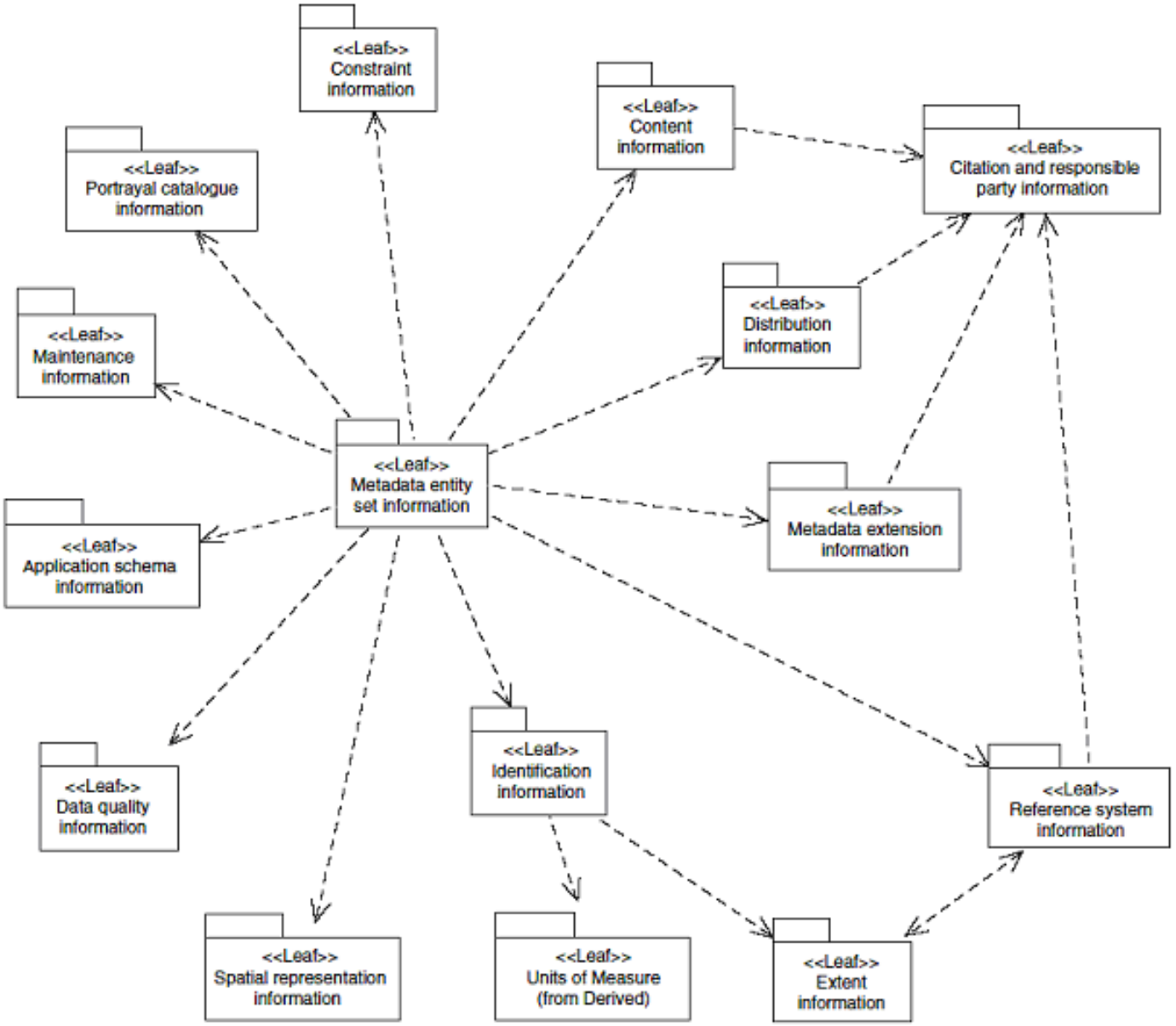
ISO 19114-Quality Evaluation Procedures

- ISO 19114:2003:
  - Provides a framework of procedures for determining and evaluating quality of digital geographic datasets.
  - Establishes a framework for evaluating and reporting data quality results, either as part of data quality metadata only, or also as a quality evaluation report.
- ISO 19114:2003 is applicable:
  - To data producers when providing quality information on how well a dataset conforms to the product specification.
  - To data users attempting to determine whether or not the dataset contains data of sufficient quality to be fit for use in their particular applications.

ISO 19115-Geographic Information-Metadata

- Published by ISO as an ISO standard in April 2003.
  - A correction to 2003 version of the standard was published by ISO in 2005 to correct editorial and minor technical errors found in the 2003 version of the standard.
- The standard defines the schema required for describing geographic information and provides information about identification, extent, quality, spatial and temporal schema, spatial reference, and distribution of digital geographic data.
- The scope of the standard includes:
  - the schema required for describing geographic information and services.
  - information about the identification, the extent, the quality, the spatial and temporal schema, spatial reference, and distribution of digital geographic data.
- ISO 19115 contains 14 packages and about 400 metadata elements.
  - described in UML and defined in the data dictionary.
  - No encoding is specified.

ISO 19115 Top-level UML



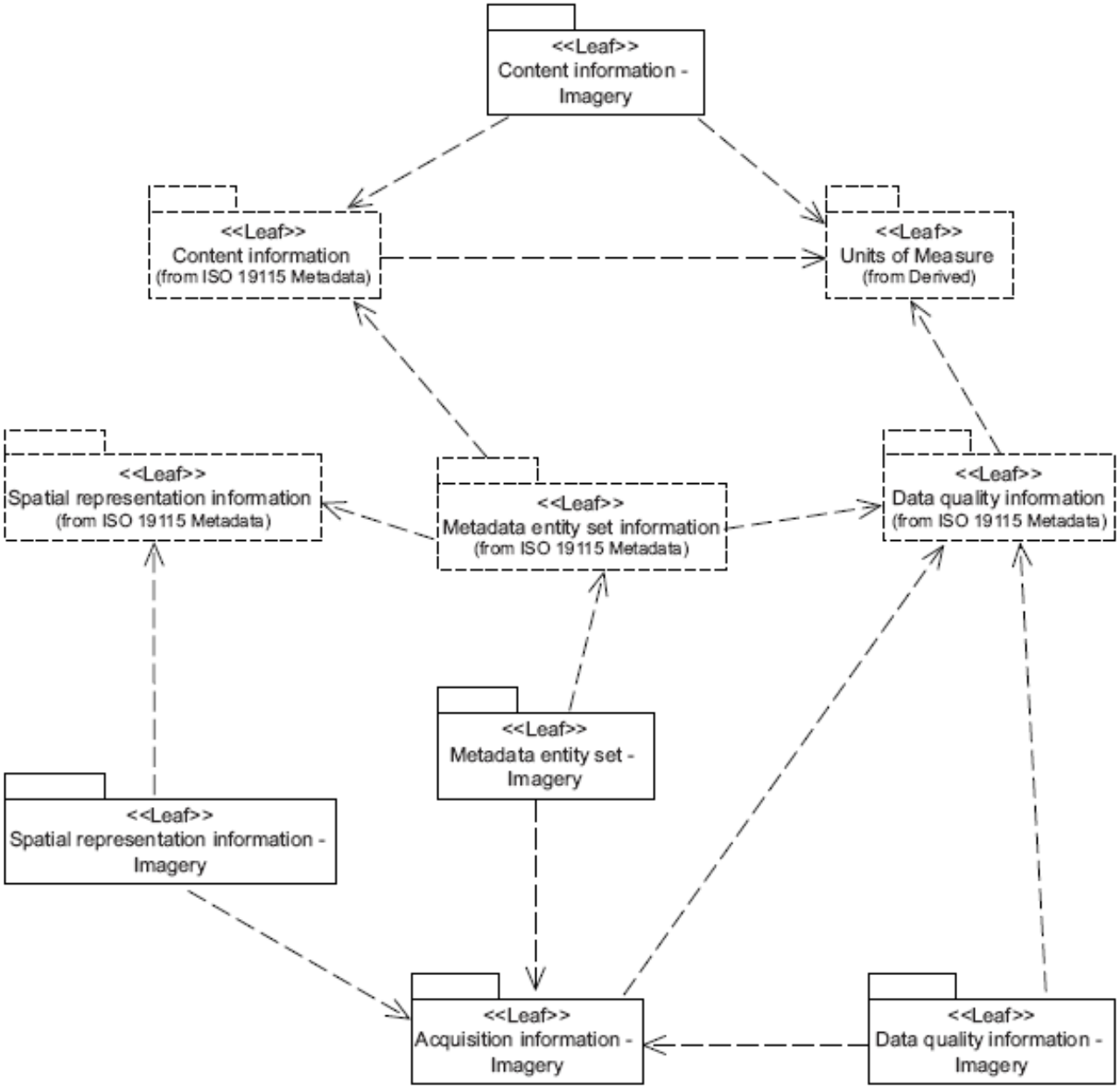
North America Profile of ISO 19115:2003

- ISO 19115 is a general geospatial metadata standard, which contains many optional and conditional metadata elements as well as a set of very generalized code lists.
  - the U.S. and Canada jointly started the North American Metadata Profile (NAP) of ISO 19115:2003 project in June 2008.
  - The objective of the project is to develop a unified 19115 profile for North America so that geospatial metadata from North America countries can be interoperable easily.
- NAP will become the U.S ANSI standard in 2009.
  - FGDC will adapt NAP as the FGDC standard for geospatial metadata to replace the current version of FGDC geospatial metadata issued in 1998.
  - Once NAP becomes the FGDC metadata standard, it will become a mandatory standard for federal agencies.
- Complying with NAP will automatically complying with ISO 19115.
  - However, complying with ISO 19115 does not necessary comply with NAP. Based on the current draft version of the NAP.

ISO 19115-2 Geographic Information – Metadata – Part 2: Extensions for Imagery and Gridded Data

- The ISO 19115-2 is an extension to ISO 19115 for supporting geospatial image and gridded data.
  - Published as an ISO standard in 2008.
- The standard is based on FGDC Remote Sensing Metadata but significantly different from it.
  - the ISO standard covers much broad scope and with many international inputs and additions.
  - Metadata in ISO 19115-2 is defined in UML while the FGDC standard is defined in production rules.
- ISO 19115-2 extends ISO 19115 by
  - defining the schema required for describing imagery and gridded data.
  - providing information about the properties of the measuring equipment used to acquire the data, the geometry of the measuring process employed by the equipment, and the production process used to digitize the raw data.
  - dealing with metadata needed to describe the derivation of geographic information from raw data, including the properties of the measuring system, and the numerical methods and computational procedures used in the derivation.

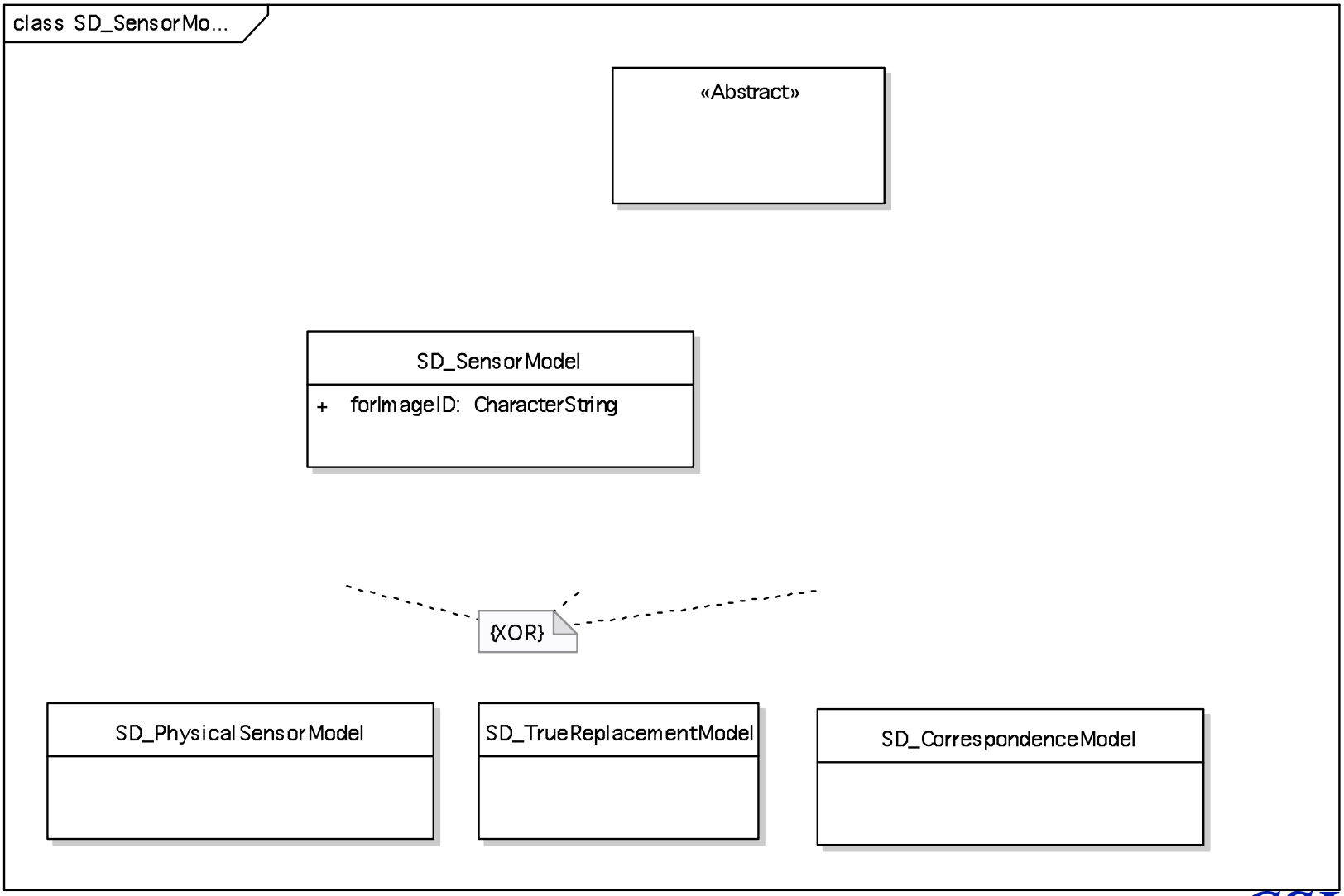
Top Level UML of 19115-2



ISO/TS 19130:Imagery Sensor Model for Geopositioning

- The Technical Specification identifies the information required to determine the relationship between the position of a remotely sensed pixel in image coordinates and its geoposition.
- ISO 19130 specifies four ways to provide geolocation information with the data
  - a sensor description with the associated physical and geometric information necessary to rigorously construct a Physical Sensor Model.
  - a True Replacement Model, using functions whose coefficients are based on a Physical Sensor Model so that they provide information for precise geopositioning, including the calculation of errors, as precisely as the Physical Sensor Model they replace.
  - a Correspondence Model that provides a functional fitting based on observed relationships between the geopositions of a set of ground control points and their image coordinates.
  - a set of Ground Control Points that can be used to develop a Correspondence Model or to refine a Physical Sensor Model or True Replacement Model.

ISO/TS 19130 Top Level UML



ISO 19138: Quality Measures

- ISO/TS 19138:2006 defines a set of data quality measures.
  - Used to report data quality for the data quality subelements defined in ISO 19113.
  - Multiple measures are defined for each data quality subelement.
    - The choice of which to use will depend on the type of data and its intended purpose.
- The data quality measures are structured so that they can be maintained in a register established in conformance with ISO 19135.
- ISO/TS 19138:2006 does not attempt to describe every possible data quality measure, only a set of commonly used ones.

ISO 19139 Geographic Information-Metadata-XML Schema Implementation

- ISO published ISO/TS 19139, Geographic information - Metadata – XML Schema Implementation in 2007.
  - define an implementation UML model based upon the abstract UML model in ISO 19115.
  - The UML implementation model may be used in conjunction with an XML schema to describe digital geographic datasets.
  - The XML encoding uses ISO 19118 rules to produce ISO 19139 XML from the ISO 19115 UML.
- The XML schema describes structure and content of the mandatory and optional elements in the UML metadata model.
  - used to validate an XML instance document conformance to the UML metadata implementation model.
- Transforming from UML profile to XML schema includes two steps as follows:
  - Output XML to be used to generate XSD
  - Transforming XML to XSD

Conclusions

- ISO TC 211 has developed a suite of metadata standards that is rich enough for describing most of geospatial data and associated sensors and platforms.
- Use of ISO standards increases the interoperability and sharing of geospatial data.